CHAPTER 9
ENVIRONMENTAL SAMPLING AND ANALYSIS

9-1. Introduction.

a. This chapter discusses the purpose, applicability and procedures for environmental sampling and analysis.

b. Purpose. When a RCWM release occurs, whether by detonation, spillage, leakage, or disposal, any media (e.g., air, soil, water), which has potentially been contaminated with chemical agent, may pose a threat to human health or the environment. The purpose of analyzing and/or monitoring representative samples of this media is to discern the presence/absence of chemical agent. This data is used to evaluate whether pre- or post-site actions are protective of human health and the environment.

c. Applicability. Environmental sampling and analysis may be performed as part of the EE/CA to characterize the site. Environmental sampling and analysis must be performed during removal actions to confirm that chemical agent contaminated media has been removed.

9-2. Contaminants of Concern (COC). During the initial phases of site characterization, COCs are determined from historical information. The actual COCs may change during the site characterization process based on additional findings. Changes in the site-specific COCs as identified in the Safety Submission and/or SSHP may require modifications to these documents if changes to the site operation procedures are required. Some types of chemical agents are not persistent in certain types of environments or after certain periods of time. The persistence of a chemical agent and its environment should be taken into consideration when determining COCs for a specific site. A list of the most common chemical agents, their breakdown products and their persistency in different environments may be found on the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) website at http://chppm-www.apgea.army.mil/dts/dtchemfs.htm.

9-3. Edgewood Chemical Biological Center (ECBC). ECBC is the government agency responsible for the development of analytical procedures and SOPs pertaining to chemical operations. On USAESCH RCWM projects, ECBC is responsible for development of the Air Monitoring Plan; conducting all monitoring for chemical agent in accordance with ECBC's Monitoring Branch Quality Control Plan; maintaining control over all RCWM monitoring data generated during the project; training and certifying personnel on operation of MINICAMS; providing and calibrating equipment for personal monitoring; calibrating, challenging, and operating MINICAMS for real time analysis support; setting up monitoring stations and collecting historical monitoring samples in support of real time monitoring; conducting on site analysis for headspace samples collected from media suspected of being contaminated with chemical agent; and maintaining all sampling records in accordance with AR 40-5

and 29 CFR 1910.120. Other responsibilities that ECBC may be required to perform during site operations are on-site analysis of environmental samples using the Mobile Environmental Analytical Platform (MEAP) or headspace monitoring environmental samples before shipping by a commercial carrier to an off-site Chemical Surety Laboratory for analysis.

9-4. Air Monitoring.

a. General. Air monitoring for chemical agent is required whenever there is a risk for worker or public exposure to chemical agent during or due to site operations. An air monitoring plan must be developed to establish the policies, objectives, procedures and responsibilities for the execution of a site specific monitoring program.

b. Purpose of Air Monitoring. The intent of air monitoring is to indicate to workers when a hazardous atmosphere is present and to maintain a record of employee exposure to airborne chemical agent, thus ensuring the safety of the operators, the environment and the public. The choice of monitoring equipment is based on the type of monitoring to be performed and the types of agent involved. The location of monitors or sample ports is based on the operation, the airflow in the area, and the location of the source of agents.

c. Monitoring Plan. DA Pam 385-61 requires that a monitoring plan be developed in writing and implemented. Generally, the air monitoring section within the SSHP and ECBC's plan satisfy this requirement. The policy requires that the plan contain the following information:

(1) A diagram of the operation.

(2) Agent(s) involved.

(3) Monitors to be used.

(4) Placement of sampling points based on characteristics of agent, airflow and monitoring equipment being used.

(5) The kind of sampling lines used, to include the length, material made from and if the sampling lines are heat traced.

(6) Provisions for low level personnel monitoring during operations.

(7) Identification of work stations where agent leakage is considered possible.

d. Monitoring Equipment. The following low level, near real time monitoring equipment is used on an agent-contaminated media site for air monitoring for agent.

(1) Miniature Continuous Air Monitor System (MINICAMS). MINICAMS is an automatic air monitoring system that collects compounds on a solid sorbent trap, thermally desorbs them into a capillary gas-chromatography column for separation and detects the compounds with a flame-photometric detector. It is a lightweight, portable, near real time, low-level monitor with alarm capability, designed to respond to GB, VX, mustard and Lewisite. However, the lewisite MINICAMS has not been approved by DA for use as a quantitative monitor. To use the lewisite MINICAMS in this capacity an exemption must be submitted for the installation or district commander's approval.

(2) Real Time Analytical Platform (RTAP). The RTAP provides an automatic, continuous, environmental monitoring system that collects compounds on a solid sorbent trap, and thermally desorbs them into a capillary gas chromatography column. The gas chromatography (GC) detects eluting compounds with a halogen specific detector (XDS), simultaneous phosphorous and sulfur, dual headed flame photometric detector (FPD), or an electron capture detector (ECD). The RTAP is a self-contained mobile platform that can be moved from site to site. It is a mobile, low level monitor designed to respond to agent present with alarm capability.

(3) Fenceline Open-path Fourier Transform Infrared Spectrometry Air Monitoring (OP-FTIR). Open-path air monitoring of gaseous compounds is a direct extension of laboratory spectroscopy systems that identify and quantify gases based on their spectral absorption characteristics. Typically, open-path systems send a beam of light through the open air, to a reflector and then back to a receiver. If gases that absorb light are present in the beam, they can be identified and quantified. This technology will not sample down to AEL for most RCWM agents.

(4) Depot Area Air Monitoring System (DAAMS). DAAMS is a portable air sampling unit that is designed to draw a controlled volume of air through a glass tube filled with a collection material (Tenax GC). As the air is passed though the solid sorbent tube, agent is collected on a sorbent bed. After sampling for the predetermined period of time and flow rate, the tube is removed from the vacuum line. The tube is transferred to the RTAP or Mobile Environmental Analytical Platform (MEAP) where it is analyzed (approximately 1 hour process time) or sent to the ECBC Monitoring Branch laboratory. The purpose of the analysis is to determine the presence, type and quantity of agent collected in the sampling tubes. This technique will sample down to the AEL for agent.

(5) Mobile Environmental Analytical Platform (MEAP). The MEAP is a self-contained mobile platform that can be moved to a project. It contains all the equipment necessary to analyze and confirm samples taken with DAAMS tubes and extracts of soil and surface water samples. It is designed as a fully functional trailer laboratory to cover the critical on-site chemical analysis and monitoring needs.

(6) Chemical Agent Monitor (CAM). The CAM is a lightweight, hand-held gross level vapor detector designed to respond to nerve and mustard agent vapors. It detects vapors of chemical agents by sensing molecular ions of specific mobilities and uses timing and microprocessor techniques to reject

interferences. When the CAM detects the presence of a chemical agent vapor, a visual display will indicate the class of agent and the relative concentration of agent. The CAM does not have an audible alarm. It has a real-time response capability for the detection of GB, VX, and mustard.

(7) Commercially Available Monitoring Equipment. For the industrial chemicals (e.g., phosgene and chloropicrin) there are commercially available instruments that may also be used on-site for air monitoring, as required.

e. Types of Monitoring. This section discusses the types of air monitoring. Table 9.1 presents a summary of these types of air monitoring.

(1) Background Monitoring. This monitoring should be conducted prior to initiation of site operations in order to provide a baseline of reference for subsequent analyses and to determine any interference in the area. DAAMS tubes and/or MINICAMS are generally used for this monitoring of the chemical agents of concern.

(2) Area Monitoring. General area monitoring provides an early warning to personnel that there is a problem and that action must be taken. The monitoring device or sampling port is placed in strategic locations in the work area where there is a potential for encountering agent vapors. The sample locations are determined based on such factors as the agent involved, the airflow patterns in the area, the operations(s) being performed, and the location of the source of the potential release. A MINICAMS, RTAP and/or commercially available monitors are used for this type of monitoring.

Table 9.1
Types of Air Monitoring

Air Monitoring	Type	Method	Purpose
Background Monitoring	Baseline	DAAMS Tubes MINICAM OP-FTIR RTAP	To provide a baseline of reference for subsequent analyses
Area Monitoring	Near-Real Time	MINICAM/ RTAP Commercially Available Monitor	To provide early, rapid warning to personnel of airborne exposure
Perimeter Monitoring	Confirmation/ Historical	DAAMS Tubes OP-FTIR	To confirm real time alarms and to provide a historical record of public exposure due to an airborne release
Mobile Area Monitoring	Confirmation/ Historical	DAAMS Tubes	To confirm the results of the real time monitors and to document conditions over time
Decontamination Monitoring	Near-Real Time Real time	MINICAMS/ RTAP CAM	To continuously monitor at the hot line to provide early, rapid warning of airborne exposure
Surface Monitoring	NA	DAAMS Tubes	To determine if surface decontamination is required for media such as scrap metal, glass, etc. that is or has a high potential to be contaminated with chemical agent
Headspace Monitoring	NA	DAAMS Tubes MINICAMS	To screen environmental samples which may potentially be contaminated with chemical agent

(3) Perimeter Monitoring. This monitoring will not be used to immediately warn of hazardous conditions, but will be used to document conditions over time and to confirm a hazardous condition that was indicated by the MINICAMS. DAAMS tube sampling stations and/ or the OP-FTIR are located at the perimeter of the work area to record any chemical agent release beyond the exclusion zone.

(4) Mobile Area Monitoring. Mobile area monitoring is a method of sampling airborne levels of contaminants in the work place. It is taken over the entire work day. A sampling train consisting of DAAMS tubes which are connected to a dual-port sampler is utilized. The dual port sampler is attached by Tygon tubing to a personal air pump. The train is calibrated to a specified air flow rate (liters per minute (LPM)).

(5) Decontamination Monitoring. Personal decontamination station monitoring is used to verify that complete decontamination of a worker or piece of equipment has been conducted. Decontamination monitoring may be conducted with a MINICAMS, RTAP or CAM.

(6) Surface Monitoring. Surface monitoring will be done on equipment and waste of any kind that is suspected to be contaminated with chemical agent in accordance with AR and DA Pam 385-61.

(7) Headspace Monitoring. Headspace monitoring will be conducted on environmental samples suspected of being contaminated with chemical agent prior to off-site shipment for analysis. This is to prevent samples contaminated above the AEL from being shipped by commercial carrier. The SOP for headspace monitoring of environmental samples is provided in Appendix E.

9-5. Environmental Sampling. Environmental sampling will be used to determine if residual chemical agent contamination from a release, spill or disposal operation is present in the surrounding environment. Environmental sampling will also be undertaken to determine if other industrial chemicals are mixed with the chemical agent of concern. The sampling of industrial chemicals of concern is necessary for the determination of the appropriateness of worker protection, to address regulatory concerns, and for disposal characterization. Environmental samples may consist of soils and other solids, water, sludge, and vegetation. Samples will be divided into a minimum of two sub-samples prior to monitoring or analysis for chemical agent. A sample will be homogenized prior to division to ensure all sub-samples have the same properties. Prior to off-site shipment, all samples (including all sub-samples) will be screened using either airborne methods to ensure concentrations are below the AEL or soil and water extraction methods to ensure agent concentrations are below detectable levels in accordance with DA Pam 385-61. The screening process is illustrated in Figure 9-1.

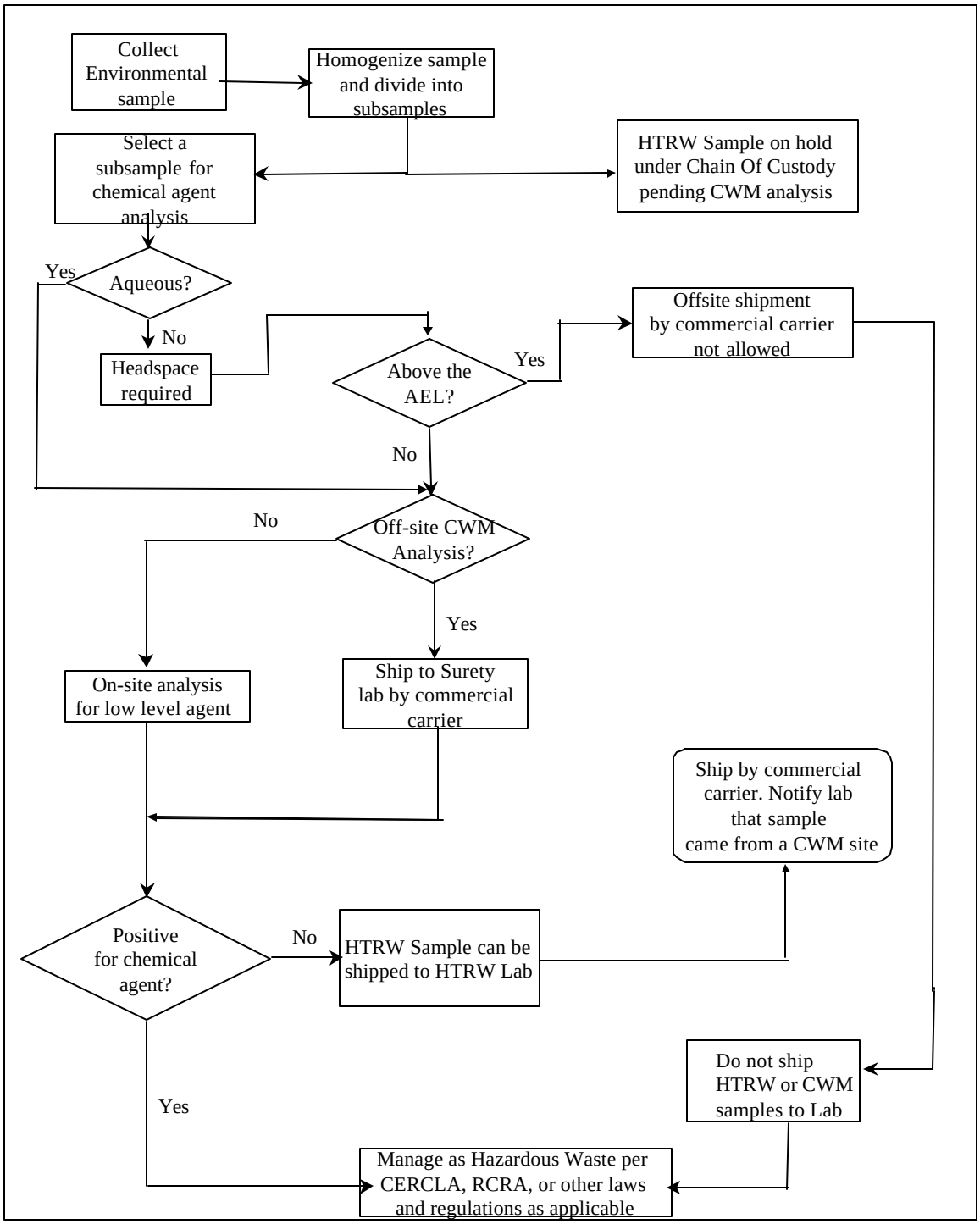

Figure 9-1. Environmental Sampling Characterization

b. Sampling Methodology. Environmental samples will be collected immediately beneath and/or adjacent to any RCWM. Samples of surrounding media should also be collected whenever there are visual or airborne indicators of potential chemical agent contamination. Historical information may also be used to determine sampling locations.

c. HTRW Analysis. If sub-samples of environmental samples are to be analyzed for HTRW contaminants, the following procedures will be followed:

(1) Samples will be homogenized prior to division.

(2) Sub-samples will be retained on-site or at a chemical surety laboratory until split samples have been analyzed by extraction and determined to be free of chemical agent contamination.

(3) Sub-samples will be head-spaced prior to off-site shipment to ensure concentrations are below the AEL.

(4) The receiving laboratory to conduct HTRW analysis is notified in writing that samples could possibly contain chemical agent contamination.

d. Shipment of Environmental Samples. Prior to shipping environmental samples off-site by commercial carrier, all samples must either be head-spaced to ensure chemical agent concentrations are below the AEL or analyzed on-site by extraction to ensure agent concentrations are below detectable levels.